

# MODULE DESCRIPTION FORM

## نموذج وصف المادة الدراسية

| Module Information                 |                                       |                                                                                                                                                                                                                                                     |                                  |
|------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| معلومات المادة الدراسية            |                                       |                                                                                                                                                                                                                                                     |                                  |
| Module Title                       | Fundamentals of Petroleum Engineering |                                                                                                                                                                                                                                                     | Module Delivery                  |
| Module Type                        | Core                                  | <input checked="" type="checkbox"/> Theory<br><input checked="" type="checkbox"/> Lecture<br><input type="checkbox"/> Lab<br><input checked="" type="checkbox"/> Tutorial<br><input type="checkbox"/> Practical<br><input type="checkbox"/> Seminar |                                  |
| Module Code                        | PE215                                 |                                                                                                                                                                                                                                                     |                                  |
| ECTS Credits                       | 6                                     |                                                                                                                                                                                                                                                     |                                  |
| SWL (hr/sem)                       | 150                                   |                                                                                                                                                                                                                                                     |                                  |
| Module Level                       | 2                                     |                                                                                                                                                                                                                                                     |                                  |
| Administering Department           | Petroleum Engineering                 | College                                                                                                                                                                                                                                             | College of Engineering           |
| Module Leader                      | Nada Sabah Sliman                     | e-mail                                                                                                                                                                                                                                              | nadasalzubaidi@alnaji-uni.edu.iq |
| Module Leader's Acad. Title        | Asst. Prof                            | Module Leader's Qualification                                                                                                                                                                                                                       | PHD                              |
| Module Tutor                       |                                       | e-mail                                                                                                                                                                                                                                              |                                  |
| Peer Reviewer Name                 |                                       | e-mail                                                                                                                                                                                                                                              |                                  |
| Scientific Committee Approval Date |                                       | Version Number                                                                                                                                                                                                                                      | 1.0                              |

| Relation with other Modules       |  |          |  |
|-----------------------------------|--|----------|--|
| العلاقة مع المواد الدراسية الاخرى |  |          |  |
| Prerequisite module               |  | Semester |  |
| Co-requisites module              |  | Semester |  |

## Module Aims, Learning Outcomes and Indicative Contents

### أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية

|                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| <p><b>Module Objectives</b><br/>أهداف المادة الدراسية</p>                | <p>By the end of this module, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Develop analytical and problem-solving skills through the application of petroleum engineering techniques.</li> <li>2. Understand the role of petroleum engineering in hydrocarbon exploration, development, and production.</li> <li>3. Gain foundational knowledge of petrophysical properties and measurement techniques, including bulk volume, grain volume, pore volume, and porosity.</li> <li>4. Explore key reservoir properties such as permeability, capillary pressure, and wettability.</li> <li>5. Perform and interpret subsurface logging techniques, including SP-log and gamma ray analysis.</li> <li>6. Recognize the contribution of geophysics to geological interpretation through the study of Earth's physical properties.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <p><b>Module Learning Outcomes</b><br/>مخرجات التعلم للمادة الدراسية</p> | <ol style="list-style-type: none"> <li>1. Describe the process of petroleum exploration, including: <ul style="list-style-type: none"> <li>• Direct indications</li> <li>• Geological methods</li> <li>• Geophysical methods</li> </ul> </li> <li>2. Explain physical measurements of subsurface conditions made from surface locations.</li> <li>3. Identify and differentiate between the three main geophysical survey techniques: <ul style="list-style-type: none"> <li>• Gravity survey</li> <li>• Magnetic survey</li> <li>• Seismic survey</li> </ul> </li> <li>4. Summarize the concept of petroleum migration and its significance in reservoir formation.</li> <li>5. Discuss the key parameters controlling petroleum occurrence.</li> <li>6. Describe the lithology of petroleum reservoirs and its impact on reservoir performance.</li> <li>7. Classify different types of petroleum traps.</li> <li>8. Distinguish between various reservoir fluid types.</li> <li>9. Understand the components and functions of a modern rotary drilling rig, including: <ul style="list-style-type: none"> <li>• Power system</li> <li>• Hoisting system</li> <li>• Rotation system</li> </ul> </li> <li>10. Circulation system</li> <li>11. Explain well control mechanisms, including blowout prevention systems.</li> <li>12. Define the concept and stages of well completion.</li> <li>13. Interpret porosity logs and understand their relevance to reservoir evaluation.</li> </ol> |

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| <b>Indicative Contents</b><br>المحتويات الإرشادية | <p>This module provides essential foundational knowledge for students pursuing careers in subsurface resource exploration and development. It emphasizes the integration of scientific reasoning, data interpretation, and societal context in petroleum engineering practice.</p> <p>Students will:</p> <ul style="list-style-type: none"> <li>• Apply the scientific method to investigate subsurface phenomena and draw conclusions based on empirical, verifiable evidence.</li> <li>• Analyze the impact of scientific theories, technological advancements, and engineering discoveries on petroleum exploration and their broader implications for society.</li> <li>• Demonstrate critical thinking and analytical skills in evaluating geological and petrophysical data, including the ability to question assumptions and assess data reliability.</li> <li>• Recognize that real-world data often contain uncertainties and develop strategies to interpret such data using sound judgment, domain knowledge, and contextual understanding.</li> </ul> |
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| <b>Learning and Teaching Strategies</b><br>استراتيجيات التعلم والتعليم |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| <b>Strategies</b>                                                      | <p>Teaching/Learning Strategies include:</p> <ol style="list-style-type: none"> <li>1- Direct Instruction in classroom, 2 hrs per week.</li> <li>2- Classroom Discussions</li> <li>3- tests, quizzes, class participation, projects, homework assignments, presentations.</li> </ol> <p>Methods of assessment for students.</p> <ol style="list-style-type: none"> <li>1- Compulsory exercises</li> <li>2- Quarterly exams.</li> <li>3- Discussions and assignments for project.</li> </ol> |

| <b>Student Workload (SWL)</b><br>الحمل الدراسي للطالب محسوب ل 15 اسبوعا           |     |                                                                            |   |
|-----------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------|---|
| <b>Structured SWL (hr/sem)</b><br>الحمل الدراسي المنتظم للطالب اسبوعيا خلال الفصل | 63  | <b>Structured SWL (hr/w)</b><br>الحمل الدراسي المنتظم للطالب اسبوعيا       | 4 |
| <b>Unstructured SWL (hr/sem)</b><br>الحمل الدراسي غير المنتظم للطالب خلال الفصل   | 87  | <b>Unstructured SWL (hr/w)</b><br>الحمل الدراسي غير المنتظم للطالب اسبوعيا | 4 |
| <b>Total SWL (hr/sem)</b><br>الحمل الدراسي الكلي للطالب خلال الفصل                | 150 |                                                                            |   |

| Module Evaluation     |              |             |                |            |                           |
|-----------------------|--------------|-------------|----------------|------------|---------------------------|
| تقييم المادة الدراسية |              |             |                |            |                           |
|                       |              | Time/Number | Weight (Marks) | Week Due   | Relevant Learning Outcome |
| Formative Assessment  | Quizzes      | 2           | 10% (10)       | 5 and 10   | LO #1, #2 and #10, #11    |
|                       | Assignments  | 2           | 10% (10)       | 2 and 12   | LO #3, #4 and #6, #7      |
|                       | Project      | 1           | 10% (10)       | Continuous | All                       |
|                       | Report       | 1           | 10% (10)       | 13         | LO #5, #8 and #10         |
| Summative Assessment  | Midterm Exam | 1 hr/1      | 10% (10)       | 7          | LO #1 - #7                |
|                       | Final Exam   | 3 hrs/1     | 50% (50)       | 16         | All                       |
| Total assessment      |              |             | 100% (100)     |            |                           |

| Delivery Plan (Weekly Syllabus) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| المنهاج الأسبوعي النظري         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                 | Material Covered                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Week 1                          | <ul style="list-style-type: none"> <li>• <b>Overview of the Oil &amp; Gas Industry:</b> Importance of Oil &amp; Gas, Key Segments of the Industry (Upstream, Midstream, Downstream).</li> <li>• <b>What is Petroleum Engineering?</b> Definition &amp; Role, Sub-Disciplines of Petroleum Engineering</li> <li>• <b>The Oil &amp; Gas Lifecycle:</b> Exploration Phase, Development Phase, Production Phase, Abandonment &amp; Decommissioning.</li> <li>• <b>Challenges &amp; Career Paths:</b> Industry Challenges, Career Opportunities</li> <li>• <b>Key Players in the Industry.</b></li> </ul> |
| Week 2                          | <b>Fundamentals of Oil &amp; Gas Drilling Engineering</b> <ul style="list-style-type: none"> <li>• <b>Drilling Rig System:</b> Rig Types, Rig Components and Functions, Drillstring and Drill Bit.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                        |
| Week 3                          | <b>Fundamentals of Oil &amp; Gas Drilling Engineering</b> <ul style="list-style-type: none"> <li>• <b>Drilling Fluids:</b> Drilling Fluid Functions, Types of Drilling Fluids, Drilling Fluid Properties.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                 |
| Week 4                          | <b>Fundamentals of Oil &amp; Gas Drilling Engineering</b> <ul style="list-style-type: none"> <li>• <b>Drilling Problems and Well Control:</b> Lost Circulation, Stuck pipe, Shale and wellbore Stability, Pressure Control</li> </ul>                                                                                                                                                                                                                                                                                                                                                                |
| Week 5                          | <ul style="list-style-type: none"> <li>• <b>Project Presentation Mini Quiz</b></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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| <b>Week 6 &amp;7</b> | <b>Fundamentals of Oil &amp; Gas Reservoir Engineering</b> <ul style="list-style-type: none"> <li>• <b>Introduction to Petroleum Reservoirs:</b> <ul style="list-style-type: none"> <li>– Definition and types of reservoirs (conventional &amp; unconventional)</li> <li>– Reservoir rock properties (porosity, permeability, saturation)</li> </ul> </li> </ul>                                                                                                                                                                          |
| <b>Week 8</b>        | <b>Fundamentals of Oil &amp; Gas Reservoir Engineering</b> <ul style="list-style-type: none"> <li>• <b>Reservoir Fluids:</b> <ul style="list-style-type: none"> <li>– Properties of oil, gas and water (PVT Analysis)</li> <li>– Phase behavior of hydrocarbons</li> </ul> </li> </ul>                                                                                                                                                                                                                                                     |
| <b>Week 9</b>        | <b>Fundamentals of Oil &amp; Gas Reservoir Engineering</b> <ul style="list-style-type: none"> <li>• <b>Natural Reservoir Drive Mechanisms:</b> Solution gas drive, water drive, gas cap drive, gravity drainage</li> <li>• <b>Fluid Flow in Porous Media:</b> Darcy's Law (single-phase and multiphase flow), Basic well productivity concepts</li> </ul>                                                                                                                                                                                  |
| <b>Week 10</b>       | <b>Project Presentation Mini Quiz</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Week 11</b>       | <b>Fundamentals of Oil &amp; Gas Production Engineering</b> <ul style="list-style-type: none"> <li>• <b>Overview of Oil &amp; Gas Production</b> <ul style="list-style-type: none"> <li>– Reservoir to refinery flow path</li> <li>– Key components of a production system</li> </ul> </li> </ul>                                                                                                                                                                                                                                          |
| <b>Week 12</b>       | <b>Fundamentals of Oil &amp; Gas Production Engineering</b> <ul style="list-style-type: none"> <li>• <b>Well Completion Basics</b> <ul style="list-style-type: none"> <li>– Casing, tubing, and wellhead equipment</li> <li>– Perforation and sand control techniques</li> </ul> </li> </ul>                                                                                                                                                                                                                                               |
| <b>Week 13</b>       | <b>Fundamentals of Oil &amp; Gas Production Engineering</b> <ul style="list-style-type: none"> <li>• <b>Artificial Lift Methods</b> <ul style="list-style-type: none"> <li>– Purpose of Artificial Lift</li> <li>– Common Lift Methods: Rod pumps (sucker rod pumping), Electrical submersible pumps (ESP), Gas lift systems</li> </ul> </li> </ul>                                                                                                                                                                                        |
| <b>Week 14</b>       | <b>Project Presentation Mini Quiz</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Week 15</b>       | <b>Fundamentals of well logging</b> <ul style="list-style-type: none"> <li>• <b>Introduction &amp; Logging Tools</b> <ul style="list-style-type: none"> <li>– Definition &amp; Purpose of Well Logging: Formation evaluation, Reservoir characterization</li> <li>– Types of Well Logs: Open-hole vs. Cased-hole logging records, Wireline vs. Logging While Drilling (LWD)</li> <li>– Common Logging Tools &amp; Measurements: Resistivity logs, Spontaneous Potential (SP), Gamma Ray (GR), Sonic (Acoustic) logs</li> </ul> </li> </ul> |

| <b>Learning and Teaching Resources</b><br><b>مصادر التعلم والتدريس</b> |                                                                                               |                                  |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------|
|                                                                        | <b>Text</b>                                                                                   | <b>Available in the Library?</b> |
| <b>Required Texts</b>                                                  | – Introduction to Petroleum Engineering, by John R. Fanchi and Richard L. Christiansen, 2017> | Yes                              |

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                          | <ul style="list-style-type: none"> <li>– Fundamentals of Drilling Engineering, SPE Textbook Series VOL. 12, by Robert F. Mitchell and Stefan Z. Miska, 2011</li> <li>– Composition and Properties of Drilling and Completion Fluids, Seventh Edition, by Ryen Caenn, H. C. H. Darley and George R. Gray, 2017</li> <li>– Fundamentals of Reservoir Engineering, by LP. Dake,</li> <li>– Oil and gas production handbook. An introduction to oil and gas production, transport, refining, and petrochemical industry, edition 3.0 Oslo, August 2013, Håvard Devold</li> </ul> | yes |
| <b>Recommended Texts</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |
| <b>Websites</b>          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |

| <b>Grading Scheme</b><br>مخطط الدرجات |                         |                     |          |                                       |
|---------------------------------------|-------------------------|---------------------|----------|---------------------------------------|
| Group                                 | Grade                   | التقدير             | Marks %  | Definition                            |
| <b>Success Group<br/>(50 - 100)</b>   | <b>A</b> - Excellent    | امتياز              | 90 - 100 | Outstanding Performance               |
|                                       | <b>B</b> - Very Good    | جيد جدا             | 80 - 89  | Above average with some errors        |
|                                       | <b>C</b> - Good         | جيد                 | 70 - 79  | Sound work with notable errors        |
|                                       | <b>D</b> - Satisfactory | متوسط               | 60 - 69  | Fair but with major shortcomings      |
|                                       | <b>E</b> - Sufficient   | مقبول               | 50 - 59  | Work meets minimum criteria           |
| <b>Fail Group<br/>(0 – 49)</b>        | <b>FX</b> – Fail        | راسب (قيد المعالجة) | (45-49)  | More work required but credit awarded |
|                                       | <b>F</b> – Fail         | راسب                | (0-44)   | Considerable amount of work required  |

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|                                                                                                                                                                                                                                                                                                                                                                                      |  |  |  |  |
| <b>Note:</b> Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |  |  |  |  |